REGIONAL VARIATION IN THE PROPORTION OF PLAIN AND BANDED FORMS OF THE RIBAND WAVE *IDAEA AVERSATA* (L.) (LEP.: GEOMETRIDAE) IN GREAT BRITAIN

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Introduction

THE RIBAND WAVE *Idaea aversata* is a common and generally distributed resident throughout most of mainland Britain, absent only from outlying Scottish islands. Dimorphism is well-known in this species. In the type form, the space between the central and postmedian lines on both fore and hind wings is filled with a darker grey suffusion to give a banded or ribbon effect, hence the vernacular name. This suffusion is lacking in ab. *remutata* Linnaeus, the plain form. Ford (1955) stated that the gene responsible for the bands is almost completely dominant, homozygotes being only slightly more extreme than heterozygotes.

However, the literature is divided about the relative proportions of the two forms in Britain. Ford (*loc. cit.*) considered that the banded form made up about 5% of the population "and there is no part of the country where it seems to be especially frequent". Yet Skinner (1998) considered both plain and banded forms to be equally common, whereas in north-east Scotland the banded form appears to be absent altogether. It seemed probable that there are indeed regional differences, and that it would be a relatively straightforward exercise to investigate these.

Methods

Waring (1999) gave a directory of moth recorders for all the Watsonian vice-counties of Great Britain. These recorders (or their successors where applicable) were asked to supply information about the relative proportions of the two forms of Riband Wave in their area. When it became clear that very little hard data were available, subscriber notices were placed in the present journal and in *Atropos*, requesting actual counts of the two forms either from previous years or in the approaching season (1999).

Recorders were trusted to identify the species correctly. There is little danger of the typical form being confused with any other species; a superficially similar banded form of the Clay Triple-lines *Cyclophora linearia* illustrated by Thomas (1999) must be very rare. The resemblance of ab. *remutata* to the relatively local and scarce Plain Wave *Idaea straminata* is undeniable. While misidentifications cannot be excluded, it was felt that they were unlikely to have a serious effect on the data, especially as most trapping sites would be gardens. Incidentally, perhaps the most reliable distinguishing feature between the two species is the terminal line, which in the Riband Wave is made up of alternating dots and dashes but consists of dashes alone in the Plain Wave. This is illustrated in Skou (1984).

Results

Perhaps fewer than half of the recorders contacted in the initial questionnaire were able to provide any information on the prevalence of the two forms. Of the replies, almost all gave general impressions not backed by hard figures. Estimates varied widely, the proportion of the banded form ranging from 5% to 80%. Doubtless many of these estimates were accurate, but unfortunately it was impossible to tell which. Certainly some recorders were confused, and had assumed that ab. *remutata* was the banded form rather than the plain. Otherwise, it appeared that the main tendency was to overestimate the frequency of the banded form, and several recorders who later made counts were surprised when it proved to be far less frequent at their own site than they had believed. Perhaps the banded form registers more strongly on the consciousness. Although these preliminary estimates were unreliable, they did confirm one valuable point: except in north-east Scotland, no recorders declared the banded form to be absent from their area.

Following the appeals for actual counts, 25 replies were received. In a few cases the sample sizes were too small for any meaningful calculation, so they provided background information only. Normally, a figure of 100 sightings was taken as the minimum required, and achieved if necessary by combining counts from different years or neighbouring localities. This relatively high figure was chosen because of the unknown effect of retraps on the calculations where a trap is being run nightly and the moths released nearby. Although some respondents were aware of it, in general lepidopterists tend to ignore this complication, treating every capture as a new individual. In my own garden I regularly retrap recognisable moths, not necessarily on consecutive nights, for up to a week or longer. The record is held by a female Spinach *Eulithis mellinata*, recaught a minimum of 19 days after being marked and released. This was during a prolonged period of poor weather, so the moth probably spent most of the intervening time sheltering under a leaf, as it was still in reasonable condition and undoubtedly would have been considered a new individual if not marked. Thus the sample sizes (as opposed to sightings) in this present study might be rather smaller than at first they appear.

In all, 21 acceptable counts were obtained from the survey, and a further four were extracted from Pratt (1999). Together they provided 25 counts from 21 (out of 112) different Watsonian vice-counties, all from England and Wales apart from my own for Banffshire. These are listed in Table 1. Considering the simplicity of the exercise and the increasing number of observers who run a moth trap, perhaps this was a slightly disappointing return.

In spite of confident claims that the banded form makes up half the population in certain areas, for instance London (Plant, 1993) and Cornwall (F. Smith, pers. comm.), the highest percentage backed by solid data from the present study was 30.3% for a rural garden in East Kent VC15, closely matched by a figure of 28.9% for West Kent VC 16. This does not necessarily

Vice County	*Site*	*Habitat*	*Year*	*Sample*	*Banded %*	*Observer*
5 South Somerset	Stoke sub Hamdon	garden	1997-8	207	**19.3**	Mark Yeates
9 Dorset	Blandford	rural garden	1999	99	**26.3**	Paul Benham
13 West Sussex	Lyminster	coastal village	1997-8	216	**21.8**	R E Pratt
14 East Sussex	Peacehaven	coastal village	1993-8	470	**24.7**	Colin Pratt
14 East Sussex	Rye Harbour	coastal village	1996	232	**22.4**	D J Funnell
14 East Sussex	Northiam	rural village	1997-8	181	**22.1**	D Burrows
15 East Kent	Kingsdown	coastal village	1999	353	**22.4**	Nigel Jarman
15 East Kent	Rainham	rural garden	1999	132	**30.3**	Owen Davis
16 West Kent	Barnehurst	suburban garden	1996-	9446	**28.9**	Tony Steele
17 Surrey	South Croydon	garden	1999	533	**27.6**	Graham Collins
18 South Essex	various sites combined	–	1999	301	**20.3**	per Brian Goodey
19 North Essex	various sites combined	–	1999	979	**23.1**	per Brian Goodey
20 Hertfordshire	Hertford	suburban garden	1999	563	**24.9**	Andrew Ward
21 Middlesex	Staines	garden	1999	358	**20.7**	John Muggleton
21 Middlesex	Northwood	suburban garden	1978-86	152	**19.1**	A M George
38 Warwickshire	Rugby	garden	1999	155	**15.5**	P F Nicholas
49 Caernarfonshire	Bangor	garden	1999	169	**16.0**	Debbie Evans
51 Flintshire	Hawarden	garden	1999	220	**14.1**	Geoff Neal
54 North Lincolnshire	Woodhall Spa	heathland	1995-8	368	**21.7**	J Jaines
58 Cheshire	Nantwich	rural garden	1995-8	495	**17.6**	Paul Griffiths
59 South Lancashire	Flixton	suburban garden	1999	619	**15.0**	Kevin McCabe
61 S.E. Yorkshire	Spurn	coastal peninsula	1999	132	**13.6**	Barry Spence
62 N.E. Yorkshire	Yarm	rural garden	1991-7	473	**14.0**	Gordon Follows
63 S.W. Yorkshire	Elland, Halifax	garden	1999	270	**21.9**	Paul Talbot
94 Banffshire	Ordiquhill	rural garden	1991-00	81	**0**	Roy Leverton

Table 1. The percentage of the banded form of the Riband Wave *Idaea aversata* in various Watsonian vice-counties of Great Britain.

suggest that estimates of up to 50% for other areas are incorrect, but clearly they need to be viewed with caution until supported by actual counts of appropriate sample sizes, given the tendency to over-estimate the proportion of banded individuals that has already been mentioned. The lowest percentage of the banded form was 13.6% in south-east Yorkshire VC61, again closely matched by a neighbouring vice-county, 14.0% in north-east Yorkshire VC62.

For the southern half of Britain, there was a tendency for the percentage of banded forms to be highest in the south, gradually decreasing northwards, as shown by Fig. 1 and Fig. 2. This relationship was analysed using Spearman Rank Correlation and was found to be highly significant, regardless of whether the Banffshire outlier was included or not:

$$rs = -0.673, df\ 24 \text{ and } rs = -0.631, df\ 23 \text{ respectively, both } P < 0.01$$

Adjacent vice-counties produced broadly similar returns, with no striking anomalies in the overall pattern. This increases confidence in the validity of the data, although it was a somewhat surprising outcome, given the widely differing opinions of the prevalence of the two forms. In fact, dimorphism in the Riband Wave shows relatively little local and regional variation (at least in the southern half of Britain) when compared with other documented instances, especially those involving melanic forms as in the Peppered Moth *Biston betularia* (Grant *et al.*, 1998).

Unfortunately, no counts were received from Britain north of Yorkshire apart from my own for Banffshire, where the banded form seems absent, likewise in north-east Scotland as a whole. M. R. Young and R. M. Palmer stated that they have never seen it in North Aberdeenshire VC93, South Aberdeen VC92 or Kincardineshire VC91 in over 25 years of recording. The moth itself is not numerous in these vice-counties, which is possibly a factor: abundant species tend to be the most variable (Leverton, 2001). It is tempting to assume that the gradual northwards decline in the percentage of the banded form continues unbroken until its absence in north-east Scotland, but there are indications that this is untrue. Keith Bland (pers. comm.) estimated the banded form to comprise 25% of the population in Mid Perthshire VC88 and East Perthshire VC89 but below 5% elsewhere in southern Scotland, while Stephen Moran (pers. comm.) estimated 30% for East Inverness-shire VC96 and East Ross VC106. Even if these estimates are too generous, the situation in Scotland seems likely to be complicated, so the absence of hard data is all the more disappointing.

Some recorders gave a breakdown of their daily catches. There was no detectable difference in capture dates between banded and plain forms, which apparently occurred in a similar ratio throughout the flight season at each site. In England the Riband Wave had an extended flight period mainly from mid-June to mid-August, the start and finish being slightly later in the north. One on 16 May 1997 in Somerset was exceptionally early. There was no evidence of a second brood as such, but occasional individuals noted in September

presumably represented a very small second generation. In Banffshire the flight period was shorter and later, mainly from the last week of July to late August.

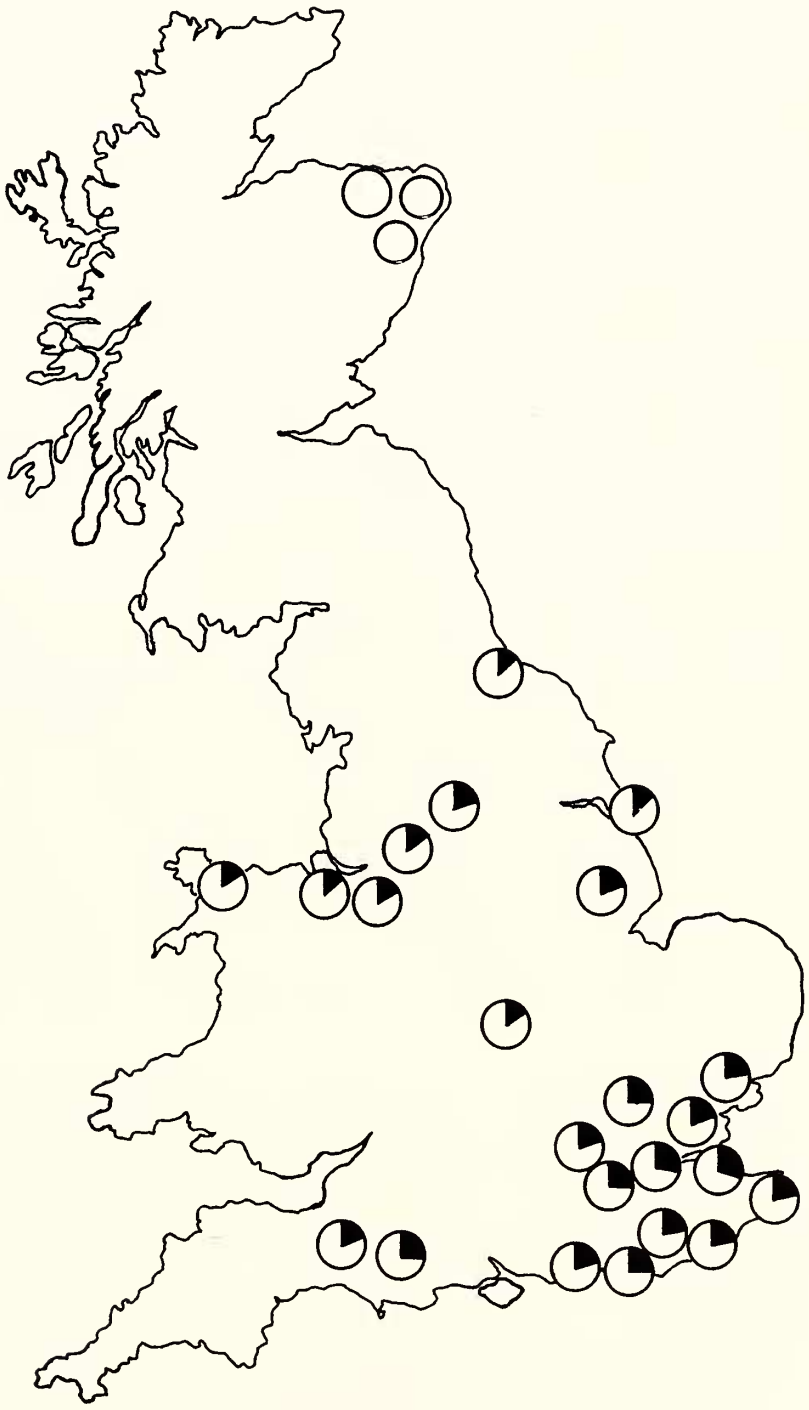

Figure 1. The proportion of banded specimens of the Riband Wave *Idaea aversata* (L.) in samples from various localities within Great Britain.

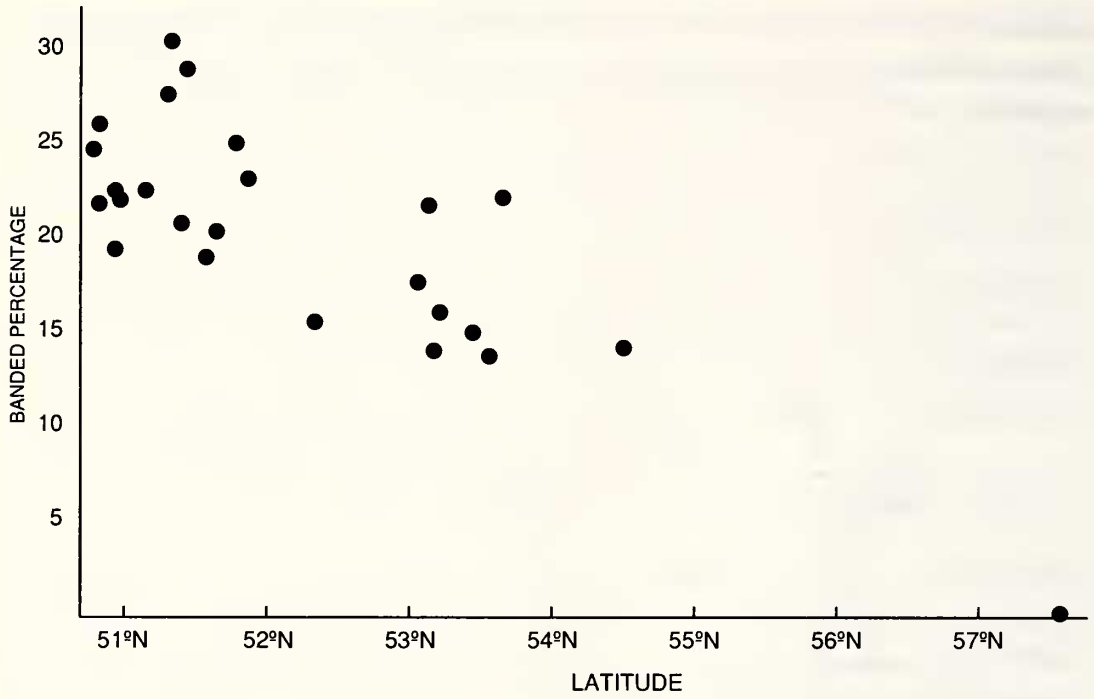

Figure 2. The percentage of banded specimens of the Riband Wave *Idaea aversata* (L.) plotted against latitude in Great Britain.

Discussion

Ford (*loc. cit.*) uses the Riband Wave to illustrate the theory of a "balanced polymorphism" – where the heterozygote has an advantage over either of the homozygotes. Thus Riband Waves with only one copy of the "banded" gene would be favoured over the plain form, but those with two copies would be at a disadvantage, presumably because they were physiologically less hardy. Natural selection would therefore create an equilibrium where the banded gene was maintained at its most advantageous level in the population, being selectively favoured when its percentage fell low but selectively eliminated if it rose so high that homozygotes became too frequent.

The surprisingly close agreement between the percentage of the banded form at sites within the same county or in neighbouring ones does suggest that some precise mathematical factor of this kind is at work, sufficient to override any variations that might be expected due to chance or to the individual characteristics of the sites. Although Majerus (1998) presents data showing that the banded form is relatively more frequent in dense closed canopy woodland than in open areas, habitat seems to have had little obvious influence on the present study, perhaps because most sites were gardens. However, the declining percentage of the banded form with increasing distance northwards suggests that climate might be a factor in the equation, but the sparseness of the data from northern Britain hinders the drawing of firm conclusions.

Acknowledgments

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Pearl Bordered Fritillary *Boloria euphrosyne* L (Lep.:Nymphalidae): A March Record?

On visiting a friend in Cambridge at the beginning of April 2001, I asked if she had seen any butterflies during the hitherto unpromising spring weather. Yes, said Mrs Rosalind Buffery, she had seen a fritillary the previous day (30 March). This seemed to me unlikely, and I suggested it might have been a Comma *Polygonia c-album*, recently out of hibernation.

Later we went around the garden, near the University Library, and there were wild violets in full flower everywhere, under the trees and in the hedges. The presence of fritillaries during the summer would not be at all unlikely, and my friend, an observant person, would assuredly have known what they looked like, and not confused them with Commas.

Consequently, my know-all attitude was almost certainly misplaced, and this was a genuine sight record of a newly hatched *Boloria euphrosyne*, near the backs in Cambridge, on 30 March 2001.– R. C. DENING, 20 Vincent Road, Selsey, West Sussex PO20 9DQ (E-mail: dening@globalnet.co.uk).